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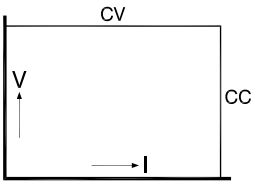
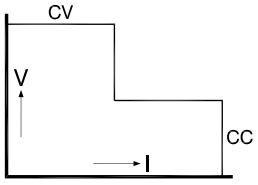
**DELTA** ELEKTRONIKA B.V.

CE

# SM 1500 - Series 1500 Watts DC POWER SUPPLIES

| Models | Voltage range | Current range |
|---|---|---|
| SM 15-100 | 0 - 15 V | 0 - 100 A |
| SM 35-45 | 0 - 35 V | 0 - 45 A |
| SM 52-30 | 0 - 52 V | 0 - 30 A |
| SM 52-AR-60<br>Autoranging output | 0 - 26 V<br>0 - 52 V | 0 - 60 A<br>0 - 30 A |
| SM 70-22 | 0 - 70 V | 0 - 22 A |
| SM 120-13 | 0 - 120 V | 0 - 13 A |
| SM 300-5 | 0 - 300 V | 0 - 5 A |
| SM 400-AR-8<br>Autoranging output | 0 - 200 V<br>0 - 400 V | 0 - 8 A<br>0 - 4 A |




## Features

- Designed for long life at full power
- Excellent dynamic response to load changes
- Protected against all overload and short circuit conditions
- EMC surpasses CE requirements:
  low emission & high immunity
- Low audible noise: fans are temperature controlled
- Available options: High Speed Programming, Interfaces, Extra Isolation, Sequencer, Digital Encoders, Power Sink etc.

## Functionalities

- Master/Slave parallel and series operation with voltage and current sharing
- Stacking is allowed, space between units is not required
- High power system configuration from multiple units
- 19" rack mounting or for laboratory use
  (feet included)
- Remote sensing
- Interlock

| | SM 15-100 | SM 35-45 | SM 52-30 | SM 52-AR-60 | SM 70-22 | SM 120-13 | SM 300-5 | SM 400-AR-8 |
|---|---|---|---|---|---|---|---|---|
| **Output** | | | | | | | | |
| voltage | 0 - 15 V | 0 - 35 V | 0 - 52 V | 0 - 52 V | 0 - 70 V | 0 - 120 V | 0 - 300 V | 0 - 400 V |
| current | 0 - 100 A | 0 - 45 A | 0 - 30 A | 0 - 60 A | 0 - 22 A | 0 - 13 A | 0 - 5 A | 0 - 8 A |
| AUTORANGING (2 ranges) | no | no | no | yes | no | no | no | yes |
| max. output current / voltage | - | - | - | 60 A / 0-26 V<br>30 A / 26-52 V | - | - | - | 8 A / 0-200 V<br>4 A / 200-400 V |
| **Input** | | | | | | | | |
| **AC** single phase, 48 - 62 Hz | 90 - 265 V | 90 - 265 V | 90 - 265 V | 90 - 265 V | 90 - 265 V | 90 - 265 V | 90 - 265 V | 90 - 265 V |
| rated voltage range | 100 - 240 V | 100 - 240 V | 100 - 240 V | 100 - 240 V | 100 - 240 V | 100 - 240 V | 100 - 240 V | 100 - 240 V |
| rated frequency | 50 / 60 Hz | 50 / 60 Hz | 50 / 60 Hz | 50 / 60 Hz | 50 / 60 Hz | 50 / 60 Hz | 50 / 60 Hz | 50 / 60 Hz |
| *Power Derating vs input:* | | | | | | | | |
| 90 V : $P_{out\ max}$ (W), $I_{in}$ (A) | 1170,16 | 1185, 16 | 1200,16 | 1200,16 | 1200,16 | 1200,16 | 1200,16 | 1200,16 |
| 100 V : $P_{out\ max}$ (W), $I_{in}$ (A) | 1317, 16 | 1334, 16 | 1350,16 | 1350,16 | 1350,16 | 1350,16 | 1350,16 | 1350,16 |
| 110 V : $P_{out\ max}$ (W), $I_{in}$ (A) | 1492, 16 | 1498, 16 | 1505,16 | 1505,16 | 1505,16 | 1505,16 | 1500,16 | 1505,16 |
| **230 V : $P_{out\ max}$ (W), $I_{in}$ (A)** | 1500, 7.5 | 1575, 7.7 | 1560, 7.7 | 1560,7.7 | 1540, 7.6 | 1560, 7.7 | 1500, 7.4 | 1600, 7.8 |
| power factor, 100%, 50% load | 0.99, 0.98 | 0.99, 0.98 | 0.99, 0.98 | 0.99, 0.98 | 0.99, 0.98 | 0.99, 0.98 | 0.99, 0.98 | 0.99, 0.98 |
| internal fuses | 25 AT | 25 AT | 25 AT | 25 AT | 25 AT | 25 AT | 25 AT | 25 AT |
| standby input power ($V_o$=$I_o$=0) | 12 W | 12 W | 12 W | 12 W | 12 W | 12 W | 12 W | 12 W |
| standby input power ($V_o$=$V_{max}$) | 22 W | 22 W | 22 W | 22 W | 22 W | 22 W | 22 W | 25 W |
| | | | | *26 V / 52 V* | | | | *200 V / 400 V* |
| **Efficiency** | | | | | | | | |
| AC 230 V input, full load | 87 % | 90 % | 90 % | 89 / 90 % | 90 % | 90 % | 91 % | 90 / 91% |
| AC 115 V input, max. load | 83 % | 86 % | 86 % | 84% | 86 % | 86 % | 86 % | 86% |
| **Regulation** | | | | | | | | |
| Load 0 - 100% **CV** | 0.5 mV | 1 mV | 2 mV | 2 mV | 2.5 mV | 4 mV | 10 mV | 12 mV |
| Line 120 - 265 V AC **CV** | 0.2 mV | 0.5 mV | 0.7 mV | 0.7 mV | 1 mV | 2 mV | 3 mV | 4 mV |
| (measured on sense block) | | | | | | | | |
| Load 0 - 100% **CC** | 5 mA | 3 mA | 1.5 mA | 2 mA | 1 mA | 0.6 mA | 0.5 mA | 0.5 mA |
| Line 120 - 265 V AC **CC** | 1 mA | 0.5 mA | 0.5 mA | 1 mA | 0.25 mA | 0.2 mA | 0.1 mA | 0.2 mA |
| (internal voltage sense) | | | | | | | | |
| **Ripple + noise** | | | | | | | | |
| rms (BW=300 kHz) **CV** | 2 mV | 1.8 mV | 2 mV | 2 mV | 3 mV | 7 mV | 7 mV | 15 mV |
| p-p (BW=50 MHz) **CV** | 8 mV | 8 mV | 15 mV | 15 mV | 15 mV | 30 mV | 50 mV | 80 mV |
| rms (BW=300 kHz) **CC** | 15 mA | 5 mA | 3 mA | 10 / 3 mA | 3 mA | 2 mA | 0.5 mA | 1.2 / 0.6 mA |
| p-p (BW=50 MHz) **CC** | 80 mA | 15 mA | 10 mA | 30 / 10 mA | 10 mA | 6 mA | 4 mA | 6 / 3 mA |
| *CC-ripple at full load* | | | | | | | | |
| **Temp. coeff., per °C** **CV** | $35.10^{-6}$ | | | | | | | |
| **CC** | $60.10^{-6}$ | | | | | | | |
| **Stability** | | | | | | | | |
| after 1 hr warm-up | | | | | | | | |
| during 8 hrs **CV** | $6.10^{-5}$ | | | | | | | |
| **CC** | $9.10^{-5}$ | | | | | | | |
| $t_{amb}$ = 25 ± 1 °C, $V_{in}$ = 230 V AC | | | | | | | | |
| (int. voltage sensing for CC-stab.) | | | | | | | | |

| **Analog Programming** | **CV** | **CC** |
|---|---|---|
| **Programming inputs** | | |
| input range | 0 - 5 V | 0 - 5 V |
| accuracy | ± 0.2% | ± 0.5% |
| offset | - 0.1 ... +1.3 mV (on 5V) | 0 ... +2.2 mV (on 5V) |
| temp. coeff. offset | 10 µV / °C | 50 µV / °C |
| input impedance | > 1 MOhm | > 1 MOhm |
| **Monitoring output** | | |
| output range | 0 - 5 V | 0 - 5 V |
| accuracy | ± 0.2% | ± 0.5% |
| offset | - 1... 0 mV (on 5V) | - 1.1... 0 mV (on 5V) |
| temp. coeff. offset | 3 µV / °C | 60 µV / °C |
| output impedance | 2 Ohm / max. 4 mA | 2 Ohm / max. 4 mA |

| | | |
|---|---|---|
| **Reference voltage** | | |
| on prog. connector | $V_{ref}$ | 5.114 V ± 15 mV (Ro = 2 Ohm, max. 4 mA) |
| | TC | 20 ppm |
| **+12 V output** | $V_o$ | 12 V ± 0.2 V |
| on prog. Connector | $I_{max}$ | 0.2 A |
| | $R_o$ | 3 Ohm |
| **Relay Outputs** | | |
| ACF | AC - Fail | both NO and NC contact |
| DCF | DC - Fail [1]) | both NO and NC contact |

[1]) output voltage ± 5% beyond set point

| | | | | |
|---|---|---|---|---|
| **Status outputs** | | | | |
| CC - status | CC - operation | 5 V = logic 1 | ($R_o$ = 500 Ohm) | |
| LIM- status | CV or CC limit | 5 V = logic 1 | ($R_o$ = 500 Ohm) | |
| OT - status | Over Temperature | 5 V = logic 1 | ($R_o$ = 500 Ohm) | |
| PSOL - status | Power Sink Overload | 5 V = logic 1 | ($R_o$ = 500 Ohm) | |
| ACF - status | AC - Fail | 5 V = logic 1 | ($R_o$ = 500 Ohm) | |
| DCF - status | DC - Fail [2]) | 5 V = logic 1 | ($R_o$ = 500 Ohm) | [2]) output voltage ± 5% beyond set point |
| **Remote ShutDown** | with + 5V, 1 mA or relay contact | | | |
| **Interlock** | contact at rear panel, see photo of rear panel on page 1-6 | | | |
| **Indicators** (front panel) | Voltage meter, Ampere meter, AC-Fail, DC-Fail, Over Temperature, Power Sink Overload, Remote-ShutDown, Remote-CV, Remote-CC, Output On, CV-limit, CC-limit, CV- and CC- mode | | | |
| **Controls** (front panel) | Mains on/off switch, CV-and CC-potmeter, CV- and CC-limit-potmeter, Display-Settings button, Display-Limits button, Remote/Local button, Output On/Off button, Front panel Lock button. | | | |

| **Programming speed** *Standard Version* | **SM 15-100** | **SM 35-45** | **SM 52-30** | **SM 52-AR-60** | **SM 70-22** | **SM 120-13** | **SM 300-5** | **SM 400-AR-8** |
|---|---|---|---|---|---|---|---|---|
| **Rise time (10 - 90%)** | | | | | | | | |
| output voltage step | 0 → 15 V | 0 → 35 V | 0 → 52 V | 0 → 26 V | 0 → 70 V | 0 → 120 V | 0 → 300 V | 0 → 200 V |
| time, (100 % load) | 6.1 ms | 15.4 ms | 7.3 ms | 8.5 ms | 13.2 ms | 3.4 ms | 9 ms | 3.7 ms |
| time, (10 % load) | 2.1 ms | 5.1 ms | 2.4 ms | 2.8 ms | 4.4 ms | 2 ms | 3.9 ms | 2.6 ms |
| output voltage step | - | - | - | 0 → 52 V | - | - | - | 0 → 400 V |
| time, (100 % load) | - | - | - | 34.2 ms | - | - | - | 15 ms |
| time, (10 % load) | - | - | - | 11 ms | - | - | - | 5 ms |
| **Fall time (90 - 10%)** | | | | | | | | |
| output voltage step | 15 → 0 V | 35 → 0 V | 52 → 0 V | 26 → 0 V | 70 → 0 V | 120 → 0 V | 300 → 0 V | 200 → 0 V |
| time, (100 % load) | 6.1 ms | 14.7 ms | 7 ms | 8.2 ms | 12.9 ms | 3.3 ms | 9 ms | 3.5 ms |
| time, (10 % load) | 61 ms | 147 ms | 70 ms | 82 ms | 129 ms | 33 ms | 90 ms | 35 ms |
| output voltage step | - | - | - | 52 → 0 V | - | - | - | 400 → 0 V |
| time, (100 % load) | - | - | - | 33 ms | - | - | - | 14.2 ms |
| time, (10 % load) | - | - | - | 330 ms | - | - | - | 142 ms |
| **Programming speed** *High Speed Version* | **SM 15-100** *Option P210* | **SM 35-45** *Option P211* | **SM 52-30** *Option P212* | **SM 52-AR-60** *Option P213* | **SM 70-22** *Option P214* | **SM 120-13** *Option P215* | **SM 300-5** *Option P216* | **SM 400-AR-8** *Option P217* |
| **Rise time (10 - 90%)** | | | | | | | | |
| output voltage step | 0 → 15 V | 0 → 35 V | 0 → 52 V | 0 → 26 V | 0 → 70 V | 0 → 120 V | 0 → 300 V | 0 → 200 V |
| time, (100 % load) | 0.20 ms | 0.27 ms | 0.31 ms | 0.44 ms | 0.47 ms | 0.46 ms | 1.0 ms | 0.35 ms |
| time, (10 % load) | 0.11 ms | 0.14 ms | 0.23 ms | 0.43 ms | 0.30 ms | 0.27 ms | 0.51 ms | 0.33 ms |
| output voltage step | - | - | - | 0 → 52 V | - | - | - | 0 → 400 V |
| time, (100 % load) | - | - | - | 0.53 ms | - | - | - | 0.98 ms |
| time, (10 % load) | - | - | - | 0.34 ms | - | - | - | 0.59 ms |
| **Fall time (90 - 10%)** | | | | | | | | |
| output voltage step | 15 → 0 V | 35 → 0 V | 52 → 0 V | 26 → 0 V | 70 → 0 V | 120 → 0 V | 300 → 0 V | 200 → 0 V |
| time, (100 % load) | 0.21 ms | 0.33 ms | 0.38 ms | 0.27 ms | 0.78 ms | 0.51 ms | 1.40 ms | 0.35 ms |
| time, (10 % load) | 1.6 ms | 3.5 ms | 3.9 ms | 3.2 ms | 8.3 ms | 4.5 ms | 13 ms | 3.8 ms |
| output voltage step | - | - | - | 52 → 0 V | - | - | - | 400 → 0 V |
| time, (100 % load) | - | - | - | 1.0 ms | - | - | - | 1.7 ms |
| time, (10 % load) | - | - | - | 9.7 ms | - | - | - | 18 ms |
| **Ripple** @full load (rms/pp) | 15/ 50 mV | 50/115 mV | 55 /135 mV | 26 V / 60 A<br>30 / 105 mV<br>52 V / 30 A<br>25 / 90 mV | 45/150 mV | 20/80 mV | 25/115 mV | 200 V<br>85 / 355 mV<br>400 V<br>60 / 245 mV |
| **Output capacitance** | 390 µF | 190 µF | 91 µF | 195 µF | 113 µF | 21 µF | 10 µF | 7 µF |

*Notes: All specifications regarding programming speed are typical and measured on a resistive load.*

| | **SM 15-100** | **SM 35-45** | **SM 52-30** | **SM 52-AR-60** | **SM 70-22** | **SM 120-13** | **SM 300-5** | **SM 400-AR-8** |
|---|---|---|---|---|---|---|---|---|
| **Recovery time** | | | | | | | | |
| recovery within | 50 mV | 50 mV | 100 mV | 26 V / 52 V<br>60 mV | 100 mV | 0.7 V | 1.0 V | 200 V / 400 V<br>1.0 / 0.5 V |
| di/dt of load step | 1.5 A/µs | 0.8 A/µs | 0.5 A/µs | 1.0 / 0.5 A/µs | 0.4 A/µs | 0.2 A/µs | 0.1 A/µs | 0.2 / 0.1 A/µs |
| output voltage | 14 V | 30 V | 48 V | 24 / 48 V | 65 V | 110 V | 280 V | 185 / 370 V |
| time, @ 50 - 100% load step | 100 µs | 100 µs | 100 µs | 100 / 100 µs | 100 µs | 100 µs | 100 µs | 100 / 100 µs |
| max. deviation | 200 mV | 150 mV | 250 mV | 200 / 100 mV | 200 mV | 2.2 V | 1.5 V | 2.5 / 1.5 V |
| *@ 230 V AC input voltage* | | | | | | | | |
| **Output impedance** | | | | | | | | |
| CV, 0-1 kHz | < 1.3 mΩ | < 1.7 mΩ | < 3.5 mΩ | < 3.3 mΩ | < 7.5 mΩ | < 63 mΩ | < 125 mΩ | < 83 mΩ |
| CV, 1-100 kHz | < 25 mΩ | < 30 mΩ | < 30 mΩ | < 40 mΩ | < 30 mΩ | < 0.6 Ω | < 1 Ω | < 1.3 Ω |
| **Pulsating load** | | | | | | | | |
| max. tolerable AC component of load current | | | | | | | | |
| f > 1 kHz | 15 Arms | 15 Arms | 13 Arms | 20 Arms | 13 Arms | 2.5 Arms | 1.2 Arms | 0.8 Arms |
| f < 1 kHz | 100 Apeak | 45 Apeak | 30 Apeak | 30 / 60 Apeak | 22 Apeak | 13 Apeak | 5 Apeak | 8 / 4 Apeak |

| | |
|---|---|
| **Insulation** | |
| 1 input / output | 3750 Vrms (1 min.) |
| creepage / clearance | 8 mm |
| input / case | 2500 Vrms |
| output / case | 600 V DC |
| **Safety** | EN 60950 / EN 61010 |
| **EMC Power Supply Standard** | **EN 61204-3**,<br>Emission: residential, **light** industrial environment (CISPR22-Class **B**)<br>Immunity: industrial environment |
| **Generic Emission**<br>**Generic Immunity** | **EN 61000-6-3**, residential, **light** industrial environment (EN 55022 **B**)<br>**EN 61000-6-2**, industrial environment |
| **Operating Temperature at full load** | – 20 to + 50 °C<br>derate output to 75% at 60 °C |
| **Humidity** | max. 95% RH, non condensing, up to 40 °C<br>max. 75% RH, non condensing, up to 50 °C |
| **Storage temperature** | – 40 to + 85 °C |
| **Thermal protection** | Output shuts down in case of insufficient cooling |
| **MTBF** | 500 000 hrs |

| | |
|---|---|
| **Hold-Up time** | |
| $V_{out}$ = 100%, $I_{out}$ = 100% | 16 ms |
| $V_{out}$ = 85%, $I_{out}$ = 100% | 20 ms |
| $V_{out}$ = 100%, $I_{out}$ = 50% | 36 ms |
| *@ 230 V AC input* | *(time till DC-fail = 1)* |
| **Turn on delay** | |
| after mains switch on | 480 ms @ 230 V AC, 700 ms @ 115 V AC |
| **Inrush current** | 27 A@115 V AC, 22 A@230 V AC |

| | |
|---|---|
| **Series operation** | |
| max. total voltage | 600 V |
| Master / Slave operation | yes |
| **Parallel operation** | |
| max. total current | no limit |
| Master / Slave operation | max. 4 units (including master) |
| **Remote sensing** | |
| max. volt. drop per load lead | 2 V |
| **Limits Voltage** adjust range | 0 - 102% |
| **Current** adjust range | 0 - 102% |
| **Potentiometers & Encoders** | |
| front panel control with knobs | standard |
| resolution | 0.03 % |
| screwdriver adjustment | Option P001 (at front panel) |
| digital encoders | Option P220 |

| | **SM 15-100** | **SM 35-45** | **SM 52-30** | **SM 52-AR-60** | **SM 70-22** | **SM 120-13** | **SM 300-5** | **SM 400-AR-8** |
|---|---|---|---|---|---|---|---|---|
| **Meters** | 3.5 digit | 3.5 digit | 3.5 digit | 3.5 digit | 3.5 digit | 3.5 digit | 3.5 digit | 3.5 digit |
| scale voltage | 0 - 15.00 V | 0 - 35.0 V | 0 - 52.0 V | 0 - 52.0 V | 0 - 70.0 V | 0 - 120.0 V | 0 - 300 V | 0 - 400 V |
| scale current | 0 - 100.0 A | 0 - 45.0 A | 0 - 30.0 A | 0 - 60.0 A | 0 - 22.0 A | 0 - 13.00 A | 0 - 5.00 A | 0 - 8.00 A |
| accuracy read output | 0.5% + 2 d | 0.5% + 2 d | 0.5% + 2 d | 0.5% + 2 d | 0.5% + 2 d | 0.5% + 2 d | 0.5% + 2 d | 0.5% + 2 d |
| read limit setting | 2% + 2 d | 2% + 2 d | 2% + 2 d | 2% + 2 d | 2% + 2 d | 2% + 2 d | 2% + 2 d | 2% + 2 d |
| (d = digit) | | | | | | | | |

| | |
|---|---|
| **Mounting** | Stacking of units allowed, air flow is from left to right. |
| **Input Connector** | IEC320/C20, EN 60320/C20 |
| **Output Terminals** | M8 bolts |
| **Programming connector** | 15 pole D-connector at rear panel (FEMALE) |
| **Cooling** | Low noise blower, fan speed adapts to temperature of internal heatsink. |
| audio noise level | ca.45 dBA at full load, 25 °C ambient temperature, 1 m distance<br>ca. 50 dBA at full load, 50 °C ambient temperature, 1 m distance |
| airflow | from left to right |
| **Enclosure** | |
| degree of protection | IP20 |
| **Dimensions** | |
| behind front panel: h x w x d | 89 x 442 x 365 mm (feet removed) |
| front panel: h x w | 89 x 483 mm (19", 2 U) |
| **Weight** | 9.9 kg |

## Typical Applications

- Solar inverter testing, PV-Simulation
- Semiconductor burn-in & processing
- Car test systems
- ATE in industrial production lines
- Lasers
- Controlled battery (dis)charging
- Component device testing
- Driving PWM-controlled DC-motors
- Accurate current sources
- Aerospace and military equipment

## Available Options

### Increased Output Power

The conservatively rated unit allows to deliver extra output with the same reliability.
At some derating, either the maximum output voltage or the maximum output current can be increased by about 10%.

- Order Code - P069

### High speed programming

A 10 to 20 times higher programming speed (down to 0.2 ms rise time at full load) and lower output capacitance.
Excellent for laser applications, test systems or as current source with low parallel capacitance as used in plasma chambers.

- Order Codes :

| | | | |
|---|---|---|---|
| SM 15-100 | P210 | SM 70-22 | P214 |
| SM 35-45 | P211 | SM 120-13 | P215 |
| SM 52-30 | P212 | SM 300-5 | P216 |
| SM 52-AR-60 | P213 | SM 400-AR-8 | P217 |

### Two-Quadrant Output: Power sink

Two quadrant operations maintains the output voltage constant regardless the output power is positive or negative. Ideal for PWM-speed controlled DC-motors and ATE systems.

- Order Codes :

| | | | |
|---|---|---|---|
| SM 15-100 | P202 | SM 52-AR-60 | P205 |
| SM 35-45 | P203 | SM 70-22 | P206 |
| SM 52-30 | P204 | | |

### Sequencer

Arbitrary Waveform generator or standalone automation.
The sequencer is integrated in the Ethernet controller.

- Order Code - P177

### High Voltage Isolation

A higher output isolation allows series operation up to 1000V.

- Order Code - P089

### Secured Voltage and Current Setting

For a maximum security,the CV/CC settings can be adjusted with a screwdriver only and are protected with a plastic cap from accidental adjusting.

- Order Code - P001

### Digital Voltage and Current Setting

Reliable, longlife digital encoders can be implemented at the front panel. Includes total front panel lock (also for CV/CC-knobs) and a coarse or fine pitch adjustment depending on the turning speed.

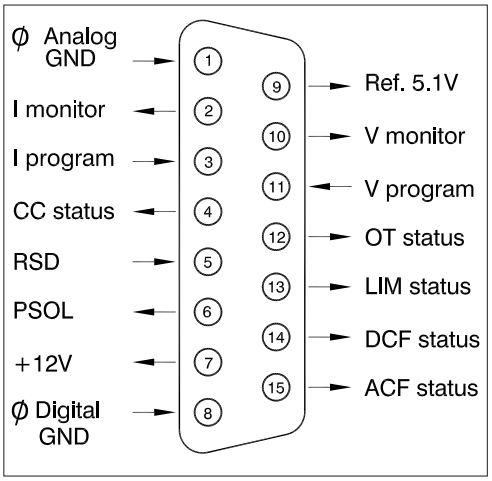
- Order Code - P220

### Software Control and Interfaces

Factory installed programming interfaces:

- Ethernet controller (incl.sequencer) - P177
- RS232 controller - P183
- IEEE488 controller - P184
- ISO AMP CARD - isolated analog - P218
- PROFIBUS controller - P273
- CANBUS controller - P274

*Note: 1. Download special datasheet about High Speed Program., Power Sink and Battery Charging from www.DeltaPowerSupplies.com.*
*2. There is only room for one of the interfaces in a unit (P177, P183, P184, P218, P273 or P274).*

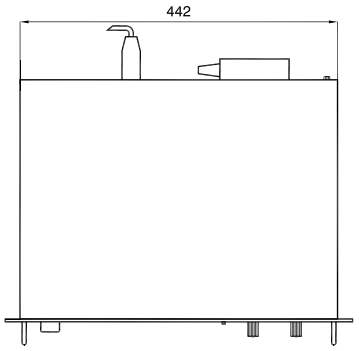


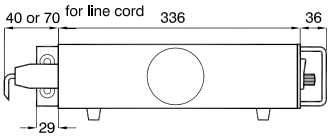

*Connections programming connector*

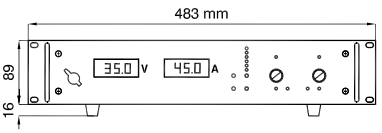
*CV = Constant Voltage*
*CC = Constant Current*

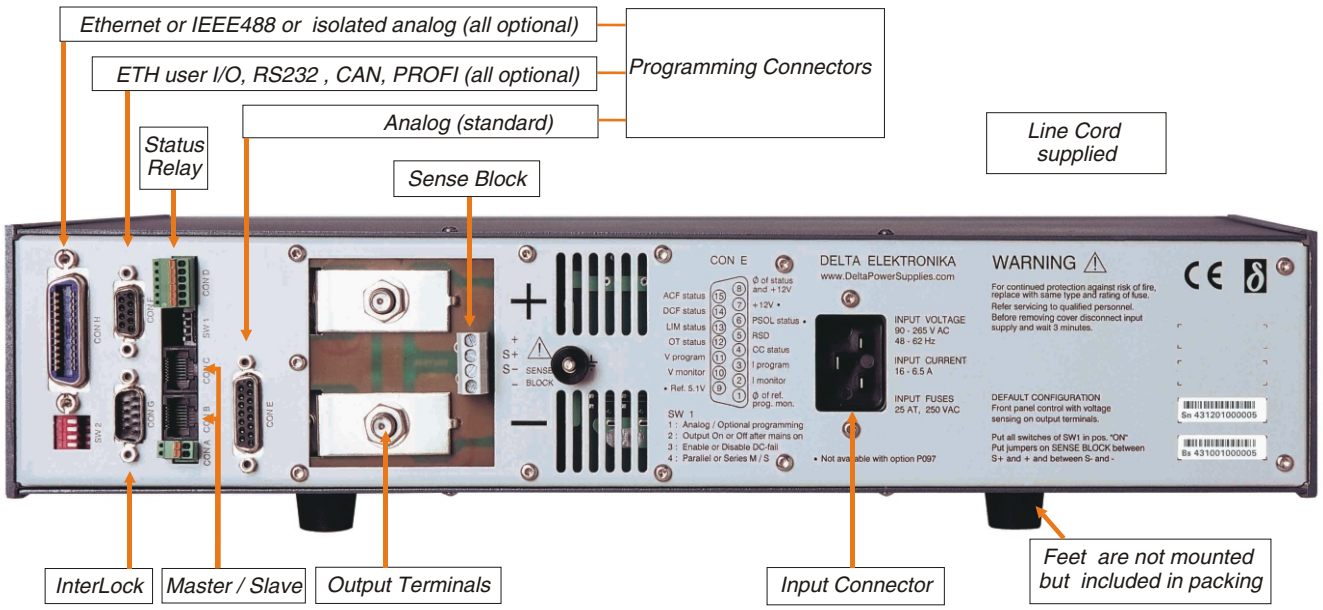
*Specifications measured at $t_{amb}$ = 25 ± 5 °C and Vin = 230 V AC, 50 Hz, unless otherwise noted.*

*The information in this document is subject to change without notice*




***Safety Cover supplied for output (not shown)***

instrumentos de medida
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